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Fire Research Group sets fire suppression speed record

by Timothy R. Anderl, Materials and Manufacturing Directorate

TYNDALL AFB, Fla. — The Materials and Manufacturing Directorate's Fire Research Group has developed the world's fastest fire suppression device.

The technology has been a laboratory phenomenon that will protect workers and reduce environmental discharges of large amounts of water saturated with munitions material. The secret of the Advanced Fire Protection Deluge System (AFPDS) is its ability to detect a fire in its beginning stage, just a few milliseconds, and provide cooling water to the burning hazard before the fire gains momentum.

Steven Wells, a project engineer who works at the group, provided attendees of the recent American Institute of Chemical Engineers Annual Meeting a preview of this device. It will extinguish highly explosive or burning materials at speeds of twenty thousandths of a second or slightly more.

Hazardous, flammable and explosive materials pose a significant risk in military plants that produce, maintain and renovate suffered loss of life and severe property damage.

The facilities also encounter problems with false alarms, because UV detector-driven suppression systems react to other stimulus in the area. False activations dump thousands of gallons of munitions-contaminated water and lead to environmental nightmares, Wells said.

"Each time a facility experienced a false alarm 'dump,' the depot lost production man-hours while technicians cleaned up," Wells said. "When AFRL was asked by the U.S. Army Operations Support Command to help determine what was causing the false alarm problem, we discovered that the suppression systems in use were much slower than needed to extinguish accidental, quickly-burning fires associated with component materials in today's munitions."

With the Army's approval, AFRL built a prototype system and started formal testing in January 1996. To date, over 200 "burn" tests have been accomplished. The prototype uses dual band infrared and combination ultraviolet/infrared optical fire detectors, high-speed pressurized water discharged from 10 and 30 liter high-rate discharge spheres, and follow-on pressurized water from standard nozzles found in existing plants and arsenal systems.

"When we combined two different detectors from different manufacturers it enhanced the system's ability to monitor and protect a single location," Wells said. "We have some materials that will start to burn slowly and get to a point where they go 'boom;' in this case we'd need a detector that sees that slow



PROJECT ENGINEER — Steven Wells examines the Advanced Fire Protection Deluge System, before testing.

burn. In other cases, when we push the button that ignites that same material, it goes 'boom' immediately. In that case we want a detector that picks up and reacts to the rapid propagation."

The detectors chosen had proven themselves for speed and immunity to false alarms while being used with Halon fire protection systems in armored personnel carriers and tanks. These detectors were subjected to additional evaluations that proved they would produce a system virtually immune to accidental discharges.

The prototype AFPDS system can be activated within a few milliseconds. When a detector recognizes a burning

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material, the controller activates a high-rate discharge extinguisher that is charged with nitrogen and water. An actuator inside the extinguisher causes the discharge of water in a fine mist, reducing the possibility of fire, explosion, environmental problems and hazardous fumes. Pressurized water from follow-on nozzles is supplied to provide

additional cooling for a period of a few seconds.

It's important to get water to the actual burning surface quickly because fire will burrow into material. "In addition, we must get water on personnel in the area immediately to eliminate the heat that could burn their skin," Wells said.

"The DoD standard, which was based on available technology, indicates that water should be present at the nozzle tip in 100 milliseconds," Wells said. "The AFPDS produces water at the nozzle tip in four to eight milliseconds, more than ten times faster than the current DoD standard. The nozzles are placed close to the hazard, so the water travels the short distance to the material in 18 milliseconds."

A high-speed heat flux sensor was installed to determine the heat flux that would be experienced by a worker under a fire scenario. During several tests the sensor was placed 24 inches from the hazardous material, an average distance in which a person would be working from the material. Test results demonstrated that personnel in that scenario would be protected.

Wells tested several existing fire protection deluge system components, and performed time detection tests on commercially available detectors and controllers.

"When we began testing, we had to evaluate the best components available in the industry and discovered that some of the controllers for existing detectors were too slow for the system we desired," Wells explained. "So we found an extremely fast controller that when modified was compatible with all the detectors evaluated. It has significantly helped increase the speed of the whole system."

"Our principal goal in this effort was to provide reliability and safety without sacrificing speed," Wells said. "We've accomplished that goal."

According to Wells, the new technology has already been installed in Picatinny Arsenal in New Jersey and is planned for installation in four other DoD-owned munitions manufacturing and inspection locations. @